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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 10/722,394 | 11/28/2003 | Hsin-Chang Wu | 4425-336 | 7178 |

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| EXAMINER | |
|---|---|
| DANG, TRUNG Q | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 2823 | |

DATE MAILED: 10/05/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 10/722,394 | WU, HSIN-CHANG | |
| | Examiner | Art Unit | |
| | Trung Dang | 2823 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *1-18* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-18* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

## DETAILED ACTION

### *Claim Rejections - 35 USC § 102*

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1-3, 6-9, and 13-18 are rejected under 35 U.S.C. 102(b) as being anticipated by Uglow et al. (US 6,251,770 B1).

With reference to Fig. 8A, the reference teaches the claimed invention in that it discloses a method for forming a dielectric layer comprising the steps of:

providing a first dielectric layer **102**; and

in-situ forming a second dielectric layer **204** having a first portion on said first dielectric layer and a second portion on said first portion, wherein said first portion has a first dielectric constant higher than said second portion has.

See col. 7, lines 1-32 in conjunction with Figs. 8A-8B for the disclosure of the dielectric layer **204** having a bottom portion (corresponding to the claimed first portion), and a topmost portion (corresponding to the claimed second portion) of carbon-doped silicon dioxide (SiOC) with high concentration. The bottom portion further comprises a lower portion of un-doped silicon dioxide and an upper portion

of SiOC with low carbon concentration. The un-doped silicon dioxide is known to have dielectric constant of about 4.1 (col.1, line 37). The SiOC topmost portion has dielectric constant of about 2.7 (col. 7, lines 10-11; lines 29-31), lower than that of the bottom portion. Note that, although the reference is silent about the adhesive property of the bottom portion of the dielectric layer **204**, such property is held inherent because the bottom portion has either zero or very low carbon content, absent evidence to the contrary.

For claims 6, 7, 13 and 14 see col. 2, lines 40-42; col. 4, lines 55-57 and col.7, lines 1-11 for the claimed in-situ forming step comprises PECVD, and the deposition having a first precursor (i.e., no carbon or low carbon concentration) for forming the bottom portion and a second precursor (i.e., high carbon concentration) for forming the topmost portion.

For claim 8, it is inherent that the un-doped silicon dioxide portion of the bottom portion has a hardness higher than the carbon-doped silicon dioxide topmost portion because un-doped silicon dioxide is known to have mechanical strength larger than that of carbon-doped silicon dioxide (reference to Andideh et al. is cited to show this fact but not used in the rejection).

For the structure claim 15, absent evidence to the contrary, the upper portion of SiOC with low carbon concentration of the bottom portion is inherently having dielectric constant around 2.8 to 3.5 as claimed because the dielectric constant of the dielectric layer **204** decreases from 4.1 (un-doped silicon dioxide portion) to 2.7

(topmost SiOC portion) as the concentration of carbon increases from zero to a predetermined value (see Figs. 8B), and, hence the claimed values from 2.8 to 3.5 must be reached before the dielectric constant dropped to 2.7.

For claims 16 and 17, see col. 4, line 40-42 for materials of the first dielectric layer **102**.

## *Claim Rejections - 35 USC § 103*

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 4-5, 10-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Uglow et al. as above in view of Lee et al. (US 6,663,973 B1).

Uglow teaches a method for forming a dielectric layer as described above.

The difference between Uglow and the claims is that while Uglow forms the dielectric film **204** having varying dielectric constant by increasing precursor gas flow so as to decrease the dielectric constant of the film from a high value to a low value, the claims call for a decrease in bias power from a high value to a low value to effectuate the same. However, Lee teaches that precursor gas flow rate and power level have profound effects on the dielectric constant of the film. That is,

under the same flow rate, increasing power level will result in a film of higher dielectric constant. On the other hand, under the same power level, increasing flow rate will result in a film of lower dielectric constant (col. 16, lines 15-26 and lines 63-67). It would have been obvious to one of ordinary skill in the art to modify Uglow's process by, while keeping the same gas flow rate, executing the chemical vapor deposition under high bias power for forming the bottom portion having high dielectric constant and then decreasing the bias power for forming the topmost portion having low dielectric constant as taught by Lee because employing alternate methods recognized in the art to achieve the same result would have been within the level of one skilled in the art. For claims 5 and 11, see Lee, col. 20, lines 5-33 for the plasma chemical vapor deposition utilizing high power that would be produced by high frequency radio frequency (HFRF).

## *Claim Rejections - 35 USC § 112*

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claim12 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 12 recites the limitations "said first bias" and "said second bias" in lines 22-23. There is insufficient antecedent basis for this limitation in the claim.

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Trung Dang whose telephone number is 571-272-1857. The examiner can normally be reached on Mon-Friday 9:30am-6:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on 571-272-1855. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Trung Dang
Primary Examiner
Art Unit 2823

9/29/04